REMARKS/ARGUMENTS

Claims 1, 7-11, 24 and 35 are active.

Claims 1 and 35 are amended to clarify that the fuel cell system is a reformed hydrogen fuel cell system as would be understood by on of ordinary skill from the specification as originally filed. The mole ratio provided in the claims finds support on pages 8 and 9 of the specification.

No new matter is added.

Applicants acknowledge the Examiner's response and discussion to the previously submitted Declaration on pages 2-3 of the Official Action. However, Applicants respectfully submit that the conclusions of obviousness underlying the rejections are erroneous and do not render the claims obvious. Conclusions of obviousness based on clearly erroneous findings, as is here the case, cannot stand. *Alza Corp. v. Mylan Labs., Inc.*, 464 F.3d 1286, 1289 (Fed. Cir. 2006).

First, consider the Examiner's statement at the end of the page 21 of the office action: "it would have been obvious... Because Pan et al. teach that optimal fuel concentration for a direct methanol fuel cell may range from 3-5% by weight in order to minimize fuel crossover." However, this statement has no applicability to the claimed invention because the claimed invention does not face the problem of the fuel crossover. As a DMFC system (such as Pan et al, and Muller et al.) does not have the reformer, fuel is directly supplied to the fuel cell stack and therefore, fuel (methanol) crossover occurs. On the other hand, as the claimed invention (RHFC system) changes the fuel to hydrogen rich gas in the reformer and supplies the hydrogen rich gas to the fuel cell stack, methanol or DME (fuel) are not supplied directly to the fuel cell stack and therefore, the crossover does not occur. This erroneous conclusion is raised again at the top of page 4 of the Action.

Note that the independent claims in the present paper have been amended to define the fuel cell system as a reformed hydrogen fuel cell system that also includes a reformer.

The cited art does not provide any suggestion for the claimed fuel components in the ratios defined in a fuel cell also including a reformer and indeed provide no indication as to how DME contributes to the reforming reaction in the fuel cell. That the art does not provide the requisite disclosure that would lead one to the claimed invention, the claims cannot be considered obvious. Further, there is nothing in what has been cited in the rejection that minimizes or contradicts the Applicants surprising findings for the claimed fuel, in the claimed mixing ratio, in the type of fuel cell being claimed.

Additionally as explained previously, the claims here include a single fuel tank storing the fuel of DME, water, and methanol. The two primary references relied upon in the rejections have two tanks separating water from methanol (see Okamoto FIG. 1 lower left portion, water tank **1** and methanol tank **2** and FIG. 1B of Pan, Fuel Tank **102** and water tank **110**). Thus, the references relied upon in the rejection teach away from that which is claimed.

The claims require a certain amount of methanol 5-10% and mixing ratio of DME to water in a single tank, that is not at all suggested. One has to ignore the teachings of the Okamoto and Pan patents to keep the methanol separated from the water and then figure out how to have a fuel that remains mixed and provides high levels of energy, e.g., unit density of energy generated. That is, the inventors have discovered a way to combine the components in a single fuel tank, while keeping the delicate balance of water solubility in the fuel and the energy output from that fuel.

Applicants have provided data demonstrating the importance of 5 to 10 % of methanol to achieve the balance between dissolubility of water in the fuel while maintaining high energy density production, all being combined in a single fuel tank.

Thus, the invention set forth in the claims cannot be considered obvious from the teachings of the cited art.

The Examiner concedes at page 4 that Okamoto does not teach or suggest the claimed fuel tank storing a fuel comprising dimethyl ether, water, and 5-10 wt% of methanol, the mixing ratio of dimethyl ether and water is in a range of 1: 3 to 1: 4 at a mole ratio.

Muller et al does not provide a teaching or suggestion of fuel defined in the claims, i.e., fuel comprising dimethyl ether, water, 5-10 wt% of methanol, the mixing ratio of dimethyl ether and water is in mole ratio in a range of 1:3 to 1:4.

At page 4 of the office action, the Examiner asserts that Muller et al. disclose a direct dimethyl ether fuel cell system (Col. 3 lines 38-55, col. Lines 7-22). At page 5 of the office action, Examiner asserts that Muller et al. teach a direct dimethyl ether fuel cell may show efficiency advantages over "other fuel cell types" (at col. 4, lines 7-22).

However, Muller et al. does not compensate for the above deficiencies of Okamoto. Namely, Muller et al. clearly fails to teach or suggest claimed mixing ratio of dimethyl ether and water is in a mole ratio of 1: 3 to 1: 4. Moreover, Muller et al. does not show evidence or examples regarding the applicability of DMFC against RHFC. As Muller et al's fuel is completely different from that defined in the claims and Muller et al's fuel cell system is quite different from claimed fuel cell system, it would be difficult to incorporate Muller et al. into Okamoto.

Indeed, the concentration of DME solution in Muller et al. is much lower than fuel in the claims. For example, Muller et al. merely teach DME solution of 1.6 mol/liter. The reason is Muller et al. cannot increase the amount of DME because Muller et al. directly supplies DME to the fuel cell stack. If the concentration of DME or MeOH is too high, crossover will occur and the catalyst in the fuel cell stack will be poisoned. Therefore, Muller's fuel cannot be within the claimed range of Applicant.

At page 5 (and page 19) of the office action, the Examiner asserts that Muller et al. teach that if methanol/DME/water fuel steam is employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency. Okamoto does not specifically teach a single fuel tank, however it would have been obvious...

Applicants cannot agree and submit that this is yet another erroneous conclusion not based on the facts of the applied references.

Muller et al's fuel cell type is DMFC. DMFC is different from the claimed reformed hydrogen fuel cell system (RHFC). As discussed in the previously submitted declaration, the S/C ratio of DMFC and the claimed invention (RHFC) are also completely different with each other. Also, DMFC and RHFC are not structurally similar. One of ordinary skill in the art would not recognize how the composition of the fuel in the claims (i.e. the mixing ratio of DME and water) contributes to the claimed RHFC system based on the disclosure of an DMFC system. Additionally, Muller et al, do not provide any evidence or examples regarding the applicability of DMFC against RHFC.

At page 6 of the office action, the Examiner states: Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10 wt% methanol. However, Pan et al. disclose a fuel delivery system ... if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5-10% by weight. Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. into the fuel cell system of Okamoto as modified by Muller et al. Because Pan et al. et al teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3-5% by weight in order to minimize fuel crossover.

Applicants cannot agree and submit that this is yet another erroneous conclusion not based on the facts of the applied references. The combination of Muller et al. and Pan et al.

does not compensate for the deficiencies of Okamoto. Namely, Pan et al. and Muller et al. clearly fail to teach or suggest claimed mixing ratio of dimethyl ether and water is in a mole ratio in range of 1:3 to 1: 4.

Pan et al, disclose in paragraph [0032] that fuel concentration may become 5%-l0% by weight if the fuel cell is to be used in the application that requires high power output.

However, this statement has nothing to do with the claimed invention. As discussed above, the cited references do not teach or suggest claimed fuel. Applicants consider that the Examiner merely focuses on each element of the fuel such as the concentration of the methanol. Examiner does not take into consideration of the claimed invention (claimed fuel) as a whole.

As Mr. Sato stated in the previously submitted declaration, it is important to include 5-l0 wt% of methanol and the mixture of "DME" and "water" having a certain mole ratio in a single fuel tank.

According to the present invention, a small and simple structure of the RHFC system can be obtained with a high efficiency for reforming fuel to hydrogen rich gas. DME and water may not be separated into two phases. Therefore, Okamoto, Muller and Fan substantially differ from claimed configuration, and cannot achieve the effectiveness of the claimed invention.

Applicants fail to understand how the Examiner's findings with respect to the scope and content of the prior art, whether supported by the cited art relate to the subject matter Applicants claim and/or would have led a person having ordinary skill in the art to the claimed subject matter. The Examiner has not established that the prior art describes or reasonably would have suggested the a reformed hydrogen fuel cell system in which the fuel as defined in the claims resides in the fuel tank. More specific to the subject matter claimed, the Examiner has not established that the prior art describes or reasonably would have

suggested the mole ratio of DME and water in such a reformed hydrogen fuel cell system. Contrary to the findings in the Action, which are erroneous, the Examiner has not explained when, how, or why the cited art's deficient disclosures reasonably would have taught a person having ordinary skill in the art to employ a specific mole ratio of DME and water in a reformed hydrogen fuel cell system as is claimed. The only suggestion to do what Applicants have done is Applicants' own disclosure, i.e. hindsight, which is improper.

As Okamoto, Muller et al. and Pan et al. fail to disclose or suggest the fuel cell defined in Claim 1 and the unexpected advantages obtained thereby, the claims would not have been obvious in view of these citations. Withdrawal of the rejection is requested.

The rejections of Claims 7 and 8 under 35 USC 103(a) in view of Okamoto, Muller, and Yonestu; based on the combination of Okamoto, Muller, and Suzki for Claim 9; or Okamoto, Muller and Kaneko for Claim 10 are also not applicable to the claims. These rejection differs from the Okamoto, Muller, and Pan rejection primarily for the reliance on (A) Yonetsu for the particular features of the fuel tank defined in claims 7 and 8; (B) the added features in Claim 9; and (C) reforming catalyst from Kaneko.

However, for the reasons similar to those detailed above, this combination of art does not provide any suggestion for the claimed fuel components in the ratios defined in a fuel cell also including a reformer and indeed provide no indication as to how DME contributes to the reforming reaction in the fuel cell. That the art does not provide the requisite disclosure that would lead one to the claimed invention, the claims cannot be considered obvious. Further, there is nothing in what has been cited in the rejection that minimizes or contradicts the Applicants surprising findings for the claimed fuel, in the claimed mixing ratio, in the type of fuel cell being claimed.

Withdrawal of these rejections is requested.

A Notice of Allowance for all pending claims is requested.

Respectfully submitted,

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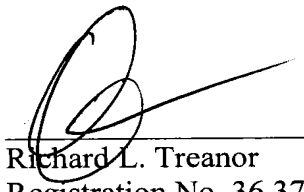

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